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PRESUPPOSITION AND SUPPOSITION IN EVERYDAY INTELLIGENCE AND LEARNING

Richard K. Wagner
Florida State University

for

Contracting Officer's Representative
Judith Orasanu

BASIC RESEARCH LABORATORY
Milton R. Katz, Director

U. S. Army
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PRESUPPOSITION AND SUPPOSITION

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Abstract

For most of this century, a close relationship between intelligence and learning has been assumed, in spite of meager empirical support. Two recent developments in the fields of intelligence and learning--increased attention to the study of performance in more realistic situations and increased attention to the role of prior knowledge in performance--have resulted in new conceptions of intelligence with implications for learning, and new conceptions of learning with implications for intelligence. One recent conception of intelligence with implications for learning, called functional theorizing (Wagner, 1986a), was the basis for two experiments that examined the role of assumptions in everyday theorizing. In Experiment 1, the role of presupposition--assumptions relevant to a learning or problem solving situation that are made before entering the situation--in everyday theorizing was examined using a theory formation task that required subjects to construe an unspecified, underlying theory from a series of exemplars. Presupposition both facilitates and inhibits successful theorizing, depending upon the congruence of presupposition with the theory to be construed. In Experiment 2, the role of supposition--assumptions relevant to a learning or problem solving situation that are based on initial experience in the situation--in everyday theorizing was examined. Irrelevant supposition as a consequence of prior theorizing is

detrimental to subsequent theorizing. The results of both experiments suggest that success at everyday theorizing depends, at least in part, upon abilities and processes other than those responsible for performance on traditional IQ tests.

Presupposition and Supposition in Everyday Intelligence and Learning

From the appearance of well-articulated theories of learning in the 1940s, a close relationship between intelligence and learning has been assumed (Estes, 1982). Today, there is little doubt that learning cannot proceed independently of intelligence (Estes, 1982), and conversely, that significant questions for the field of intelligence necessarily involve questions about the nature of learning (Glaser, 1986). There is a growing acceptance of the view that "learning and intelligence must be studied as continuously interacting components of the individual's whole cognitive system" (Estes, 1982, p. 191).

The assumption of a close relationship between intelligence and learning is reflected in the fact that intelligence has commonly been conceptualized in terms of an individual's ability to learn. In a 1921 symposium on "Intelligence and its Measurement" published by the Journal of Educational Psychology, a number of leading researchers of the day conceptualized intelligence in terms of learning ability. Colvin viewed intelligence as "the capacity to learn," and similarly, Dearborn viewed intelligence as "the capacity to learn or to profit from experience." Learning ability also figured prominently in the views of Henmon and Woodrow. More recently, Gagne (1968) has identified intelligence with the cumulative products of learning,

and learning appears as a prominent feature in a number of recent multifaceted theories of intelligence--either in terms of the processes by which knowledge is acquired (Sternberg, 1985), or in terms of the knowledge itself (Glaser, 1986) (see also, Brown & Campione, 1986; Butterfield, 1986; Snow, 1986).

Historically, conceptualizing intelligence in terms of learning ability has generated considerable empirical activity, the results of which provide surprisingly little support for a close relationship between intelligence and learning. Beginning with Spearman (1904), a long series of studies ensued that examined correlations between performance on laboratory learning tasks and psychometric intelligence tests. The upshot of these studies is that there is a reliable but modest (.2--.4) relation between performance on laboratory learning tasks and intelligence, falling far short of what would be expected if there indeed was a close relationship between intelligence and learning (Cronbach & Snow, 1977; Estes, 1982; Snow & Yalow, 1982; Woodrow, 1940; Zeaman & House, 1967).

On both theoretical and logical grounds, it would appear that there must be important relations between intelligence and learning, but after decades of study of both intelligence and learning, the nature of these relations remains a perplexing mystery (Butterfield, 1986; Estes, 1982). Why, after so much

effort, is there so little understanding of the relationship between intelligence and learning?

Part of the problem may be that learning and intelligence began and evolved as separate disciplines, a separation perpetuated by the fact that most new research grows directly from old research (Estes, 1982). Another part of the problem may be that whereas conceptions and measurement operations of both learning and intelligence have been extraordinarily useful for some purposes, the same conceptions and measurement operations have been less useful for other purposes, including understanding how intelligence and learning are related. Learning research has too often been based on the unfounded assumption that the principles of learning can be studied in their entirety using highly simplified learning tasks (Estes, 1982); intelligence research has too often been based on the unfounded assumption that intelligence, as measured by traditional psychometric tests, is equivalent to intelligence as it operates in the everyday world (Neisser, 1976; Glaser, 1986; Wagner & Sternberg, 1985).

Two relatively recent developments, which occurred simultaneously in the fields of intelligence and learning, have implications for understanding of relationships between intelligence and learning: The first development is increased attention to the study of performance in more realistic

situations; the second, concomitant, development is increased attention to the role of prior knowledge in performance.

Turning first to the field of learning, there is a growing body of learning research that is based on more realistic tasks, including those we might characterize as school learning (Brown, 1982; Greeno, 1980; Siegler, 1983; Siegler & Klahr, 1982; Snow & Yalow, 1982, Voss, 1978). It is likely that performance on such tasks is more closely related to intelligence than is performance on simplified laboratory tasks (Estes, 1982). For example, typical correlations between IQ scores and various indices of school learning (.4 to .7) are roughly double the correlations between IQ and performance on laboratory learning tasks.

Increased attention to the role of prior knowledge in learning is evident in the view that more of what remains to be learned about learning--including further understanding of basic principles--will come from study of interactions of new information with existing knowledge structures, rather than from further study of tasks that minimize the role of prior knowledge in performance (Greeno, 1980; Siegler, 1983).

Turning to the field of intelligence, a recent development has been a growing body of research on intelligence as it operates in the everyday world (see Sternberg & Wagner, 1986, for a collection of recent approaches). Increasingly, a distinction is made between academic and practical intelligence. Neisser (1976)

has described the tasks found on IQ tests and in academic settings as measures of academic intelligence. Tasks such as these are characterized by being (a) formulated by others, (b) disembedded from ordinary experience and often having little or no intrinsic interest, (c) well-defined and having all need information available from the beginning, and (d) linear, in that there is but one correct solution and one means of obtaining it (Neisser, 1976; Wagner & Sternberg, 1985). In contrast, Neisser has defined intelligent performance in natural settings, or practical intelligence, as "responding appropriately in terms of one's long-range and short-range goals, given the actual facts of the situation as one discovers them" (p. 137).

Increased attention to the role of prior knowledge in intelligent performance is evident by the interest in the study of expert-novice differences in a variety of domains (see Chi, Glaser, & Rees, 1982, for a review of this literature). An important conclusion from the study of expert-novice differences is that experts differ from novices primarily in their knowledge than can be brought to bear on a task, and in how this knowledge is structured, rather than in their underlying cognitive abilities.

An example of research on intelligence that focuses on everyday as opposed to academic tasks, and on the role of prior knowledge, is the study of tacit knowledge in several real-world

pursuits (Wagner & Sternberg, 1985, 1986; Wagner, 1986b). Tacit knowledge in this context refers to practical know-how that usually is acquired informally from everyday life rather than from formal training and schooling. Tacit knowledge has been measured through the use of inventories constructed for domains such as academic psychology and business management. These inventories present simulated work-related situations, and ask the respondent to generate or evaluate a number of alternative responses. The results of five experiments carried out in the domains of academic psychology and business management suggest that individual differences in facility for acquiring tacit knowledge are related to a variety of measures of career performance in both domains. Further, individual differences in rate of acquisition of tacit knowledge does not appear to be related closely to IQ.

The present article examines several implications of a recent theory of intelligence called functional theorizing (Wagner, 1986a). The theory (a) purports to account for everyday as well as academic aspects of intelligence, (b) focuses on the acquisition, structure, and use of real-world knowledge in intelligent performance, and (c) is one example of an approach that considers learning and intelligence to be continuously interacting components of the individual's whole cognitive system.

Functional Theorizing

Three assumptions of the theory are of interest for present purposes.

1. <u>Intelligence is the ability to construct functional theories about oneself, others, and one's environment.</u>[1]

Consider the individual parts of this working definition of intelligence. First, compared to the common definition of intelligence as the ability to adapt to one's environment, the present definition focuses on an intellectual endeavor (theory construction) to the exclusion of nonintellectual characteristics, such as physical size, that can be adaptive in certain environments. Second, the focus is on a specific kind of intellectual activity--theory construction--as opposed to more generic kinds of intellectual activity such as reasoning or problem solving. Third, the term functional implies that the goal is to develop theories that are useful for some purpose. Fourth, defining intelligence as the ability to construct functional theories ties intelligence to learning, because learning obviously is an essential part of theory formation.

2. <u>Functional theorizing, a term that refers to the collection of processes and knowledge that underlie theory construction, is defined as the forming and re-forming of assumptions and conceptualizations as a result of repeated interactions of observation and reasoning (Marx, 1976). The most</u>

<u>salient characteristic of functional theorizing is that of bootstrapping</u>.

The major obstacle to be overcome by theorizing is known as the paradox of conceptualization: Proper concepts and observations are needed to formulate a good theory, but a good theory is needed to formulate proper concepts and observations (Kaplan, 1964).

Bootstrapping refers to a self-starting mechanism. For example, when one turns on a personal computer, the computer automatically runs through a series of operations that include activating the disk drive and reading the operating system from the disk contained therein. These automatically executed operations, that are necessary to bring the computer to life, are contained in what is called the bootstrapping program.

In the present context, bootstrapping is used to resolve the paradox of conceptualization through a process of successive approximation: One attempts to understand a situation by assuming a set of concepts and observational procedures, and then uses the concepts and observational procedures to construct a tentative explanatory framework or theory. Evaluation of the tentative theory enables refining the initial set of concepts and measurement operations, which in turn enables refining the theory. This cycle continues until the theorist is satisfied that the theory is sufficient for its intended purpose.

3. <u>There are important and useful analogies between scientific and everyday theorizing</u>. This is not to say that individuals in their everyday lives think in the rigidly formal and objective "scientific" way that is taught in introductory research design and methods courses. The analogy holds because scientists do not think this way either (Marx, 1976).

Before describing the two analogies that were examined in the present experiment, it is useful to consider briefly the specific view of scientific theorizing that serves the theory as a source of analogies to everyday theorizing. This view of scientific theorizing is that of constructionism, and three of its facets are directly relevant for present purposes.

First, facts do not have an existence independent of theory or paradigm (Kuhn, 1970). This means that there is not one set of absolute or real facts waiting to be discovered, but rather many sets of facts arising from alternative theory-guided points of view (Scarr, 1985). Some facts are tied closely to sensory observation (e.g., I am thirsty) but others are not (e.g., I was born in 1952). Facts are relative to time and place, and to the populations that accept them. For example, it once was an accepted fact that the planets circled the earth. What apparently makes facts "factual" is social consensus, which in turn is based upon belief and trust.

Second, theories are created by theorists rather than being predetermined by nature or by data (Hall & Lindzey, 1970; Marx, 1976), and thus, for any given phenomenon, there are at least as many possible theories as there are theorists to propose them.

Third, theories can neither be true nor false. However, this does not imply that one theory and its associated facts is as good as another. Theories can be judged by how functional they are for their intended purposes.

The concern of the present paper is two particular analogies between scientific and everyday theorizing. The first concerns presupposition in everyday theorizing; the second concerns supposition in everyday theorizing.

Presupposition and Supposition in Everyday Theorizing

Presupposition refers to assumptions about a learning or problem solving situation that are made before actually getting underway. For example, when information processing psychologists test alternative processing models of say, working memory, they presuppose or assume (often tacitly) that (a) elementary information processes exist, (b) information exists that information processes operate on, (c) there exists a rough analogy between the way in which humans and computers process information. Note that assumptions such as these can be made for the purpose of providing a framework for one's investigation, without necessarily

implying that, for example, elementary information processes really exist "in the head."

Presupposition is a necessary part of all learning and problem-solving. Not everything can be problematical at once (Kaplan, 1964). The full-blown complexity of any learning task or problem would induce immediate paralysis were it not for presupposition, which serves as a set of blinders to irrelevant features. An important characteristic of presupposition is that much of it is done "without thinking."

Supposition refers to assumptions and beliefs that arise soon after inquiry gets underway. In scientific theorizing, suppositions are hunches based upon limited experience or data that will either be borne out or refuted by subsequent experience or data. For example, based on pilot data, an investigator might suppose that there are important, qualitative, individual differences in the way people make judgments about spatial locations. Based upon this supposition, the investigator may adopt a strategy of fitting models to the data from individual subjects as well as to the combined group data, and may decide that more than one model is needed to account for individual differences in spatial processing.

Suppositions are important because one evaluates subsequent experience in relation to them. Thus, suppositions often have a

disproportionately greater influence than is warranted by the limited amount of experience on which they are based.

That both presupposition and supposition play important roles in scientific theorizing is well established. It is never possible in science to "start from scratch" (Kaplan, 1964). The beginning of any inquiry involves a set of assumptions, regardless of whether the inquirer acknowledges them. Science can only move from less knowledge to more, from knowledge presumed to knowledge accepted. Presupposition, especially, appears to play a major role in scientific advances, which come about more often from recognizing and challenging previously unrecognized and unchallenged presuppositions than from simple empirical (dis)confirmation of theory (Kuhn, 1970). Consider now an example of presupposition and supposition in everyday theorizing. The problem I will describe is authentic and concerns computers, but one need not have experience with computers to follow it.

I use a modem--a device that allows computers to communicate over telephone lines. The modem can send and receive information at one of two speeds, high or low, and the speed is controlled by a communications software program. The problem is that after working perfectly at high speed for over a year, the modem suddenly began operating only in low-speed mode.

What I knew about the problem (especially that it appeared without my having changed anything) and the workings of the modem,

communications program, and computers was the basis for the following presupposition: There were two likely sources of the problem; either a bug had developed in the communications program that controlled the modem, perhaps because of the effect of static electricity on diskettes, or the modem had developed a hardware problem.

To rule out the possibility of a problem with the communications program, I tried another copy of the program: the problem remained. Next, I gave the modem a command that should override the communications program and switch the modem to high-speed mode: The modem indeed switched to high-speed mode, but there now was gibberish on the screen.

The results of these two initial tests were the basis of the following supposition: The source of the problem was that the modem had developed a hardware problem. If a bug had developed in the communications program, especially because of a flaw in a diskette, it is unlikely that the same bug would appear in the other copy of the program I tried. Also, the unintelligible output when I forced the modem into high-speed is consistent with a hardware problem.

The outcome of having the modem serviced by an electronics shop was that the presupposition was correct, but the supposition was not. The problem was not in the modem at all, but in the communications program that controlled it. For some mysterious

reason, the communications program that had worked perfectly before had begun to provide the modem with an erroneous information (a communication parameter for number of stop and start bits for those who know what such things mean) that made it unable to communicate in high-speed mode, but able still to communicate in low-speed mode. I cannot explain how the problem showed up in both copies of the communications program, but surmise that the copy I tried as a test was made after the problem developed in the original copy.

Theory Formation Task

The task used to investigate supposition and presupposition in everyday theorizing required subjects to construe an unspecified, underlying theory from a series of examples. The task is similar in form to tasks used to study concept formation (Mayer, 1977).[2] In a typical concept formation task, subjects are presented a set of geometric objects of different sizes. Their task is to discover an underlying concept such as red triangle. For each trial, subjects guess whether the presented form is an exemplar of the to-be-discovered concept and then learn whether they were correct. Subjects presumably use such feedback to determine what the concept is.

The differences between the theory formation task and the typical concept formation task center on the nature of the underlying theories to be construed. Compared to concepts used in

typical concept formation tasks, the underlying theories were more abstract, more complex, and less directly represented by the exemplars presented to subjects. Additionally, to allow for the fact that the exemplars varied in similarity to the prototype represented by an underlying theory, subjects used a 5-point scale rather than a dichotomous "yes-no" scale to indicate the degree of match between exemplar and underlying theory. This same 5-point scale was used to provide feedback to subjects. Finally, the theory formation problems dealt with everyday tasks such as purchasing an automobile, selecting an apartment, and choosing a roommate, for which substantial real-world knowledge presumably exists.

Manipulating Supposition and Presupposition

The focus of Experiment 1 was an implication of the assumption of analogous relations between scientific and everyday theorizing. The implication is that just as presupposition plays an important role in scientific theorizing, it also plays an important role in everyday theorizing. There were three specific questions of interest regarding presupposition in everyday theorizing. First, are there effects of manipulating presupposition on the success of everyday theorizing? Second, if such effects exist, do they facilitate or inhibit success at everyday theorizing? Third, how durable are effects of manipulating presupposition on everyday theorizing?

Presupposition was manipulated in this experiment by varying preliminary information presented at the beginning of each problem that was intended to generate presuppositions that were either congruent with, incongruent with, or irrelevant to the underlying theory to be construed.

The focus of Experiment 2 was also an implication of analogous relations between scientific and everyday theorizing. The implication is that supposition as a function of irrelevant initial theorizing will inhibit the success of subsequent theorizing. Supposition was manipulated by switching the underlying theory to be construed midway though a problem. By counterbalancing order of presentation of underlying theories within problems in a manner to be described shortly, it was possible to examine the effects of irrelevant supposition on subsequent theorizing.

An additional question of interest for both experiments concerned the theory formation task itself. The problems presented subjects were practical ones of the sort they might encounter in their everyday lives, although there is no reason they could not have been academic-type problems. However, with the practical problems used, it is necessary to show that the theory formation task is not just a fancy IQ test before the task can be viewed as a measure of practical as opposed to academic theorizing. To address this issue, subjects were given a

standardized test of verbal reasoning. If the theory formation task is just a fancy IQ test, performance on the task should be reliably and substantially related to verbal reasoning ability.

Experiment 1

Method

Subjects

The subjects were 82 undergraduates who received course credit for their participation, which took approximately 90 minutes.

Materials

The materials consisted of nine theory formation problems. Three of the problems were about purchasing a car, three were about selecting an apartment, and three were about choosing a roommate.

A different theory was used for each of the nine problems. An example of a theory for a problem dealing with purchasing a car is, "I want a car that will meet the needs of my family." Associated with each theory was a pair of constructs. Examples of constructs associated with the family-car theory include "functional" and "safe". Associated with each construct were a number of concrete descriptions. Examples of concrete descriptions for the construct functional include "ample storage space" and "4-doors." Examples of concrete descriptions for the construct safety include "good crash test rating" and "fuel tank near rear

axle to avoid rupture." The nine theories, their associated constructs, and a sampling of concrete descriptions are presented in Table 1.

Insert Table 1 about here

Each problem began with a brief description of an individual whose stated intention was either to purchase a car, to select an apartment, or to choose a roommate, depending upon which type the problem was. This description was followed by a series of 10 cases. For the purchasing a car problem type, each case consisted of a paragraph containing 10 descriptions of a particular car. A sample case for one of the car purchasing problems is presented in Table 2. Cases for the selecting an apartment and choosing a

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Insert Table 2 about here

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roommate problem types consisted of 10 similar descriptions of an apartment or a roommate, respectively.

The subjects' task for each problem was to predict on a 5-point scale the degree to which the individual who had been described at the beginning of the problem would like the car, apartment, or roommate described in a given case. Subjects were provided the following scale to use in making their predictions:

+2 = likes a lot; +1 = likes somewhat; 0 = neither likes nor dislikes; -1 = dislikes somewhat; -2 = dislikes a lot. After making their prediction, the same 5-point scale was used to give subjects the "true" rating, that is, the extent to which the individual really liked what was described by the given case as determined by the underlying theory. How the true rating was derived will be described shortly. The important point here is the feedback provided by comparing one's predicted rating to the true rating could be used to improve one's predictive accuracy for subsequent cases, in the same problem.

Before describing how the true ratings were determined, it is necessary to describe how the construct descriptions were generated and combined to form cases. I will describe this procedure for one of the car selection problems. Similar procedures were used for the other two problem types.

Three underlying theories and eight associated constructs were identified initially for the car purchase problems by the experimenter. A pool of 53 concrete descriptions was developed for these constructs. Six undergraduates then were given randomized lists of the concrete descriptions. Their instructions were to indicate whether a given description was positively related, negatively related, or unrelated to each of the eight constructs.

Descriptions were combined into cases so as to yield problems corresponding to each of the five points on the rating scale. A "+2" case was constructed by combining five positively related and five unrelated descriptions. A "+1" case was constructed by combining three positively related and seven unrelated descriptions. A "0" case was constructed by combing 10 unrelated constructs. A "-1" case was constructed by combining three negatively related and seven unrelated descriptions. Finally, a "-2" case was constructed of five negatively related and five unrelated descriptions. Each problem was made up of two each of the five kinds of cases, for a total of 10 cases.

Presupposition was manipulated by altering a brief description presented at the beginning of each problem of the individual whose ratings were to be predicted in the following manner.

Three versions of the descriptions were constructed to generate different presuppositions. A different version was given to each of three groups of subjects. The descriptions of individuals presented at the beginning of each problem to members of the _congruent presupposition_ group were chosen so as to generate presuppositions that were congruent with the theories underlying the problems. An example of such a description for the family-car problem is: "Jim Smith is 43 years old. He is married and the father of four children, ages 5, 7, 10, and 15. The

Smiths have two dogs and a cat, and enjoy doing activities as a group."

The descriptions of individuals presented at the beginning of each problem to members of the incongruent presupposition group were chosen so as to generate presuppositions that were incongruent with the theories underlying the problems. An example of such a description for the family-car problem is: "Jim Smith is a freshman at UCLA. He is more interested in his social life than in his academic studies. In fact, he chose UCLA over USC because he heard the women were more attractive at UCLA."

The descriptions of individuals presented at the beginning of each problem to members of the neutral presupposition group were chosen so as to generate presuppositions that were neither congruent nor incongruent with the theories underlying the problems. An example of such a description for the family-car problem is: "Jim Smith was born in Pennsylvania. His favorite colors are red and yellow. He considers himself to be a good person, though one who has had perhaps more than his share of luck."

To examine relations between performance on the theory formation task and academic intelligence, the Verbal Reasoning subtest of the Differential Aptitude Tests (Bennett, Seashore, & Wesman, 1974) was given. Additionally, to examine relations between amounts of real-world experience and performance on the

theory formation task, subjects were asked to provide estimates of the number of times they actually had purchased cars, selected apartments, or chosen roommates. However, subjects reported making such decisions only about once, on average: The mean number of cars purchased, apartments selected, and roommates chosen were 0.9, 0.6, and 1.6, respectively. Floor effects rendered these data meaningless, and they will not be considered further.

Design

Subjects were randomly assigned to the congruent, incongruent, and neutral presupposition groups.

All subjects were presented with the same 9 problems, each made up of 10 cases. The problems were presented in the same order for each subject so as to facilitate analyses of individual differences in task performance. Problems were blocked by type, meaning that the car selection problems were presented first, followed by the apartment selection problems and then the roommate selection problems, so that subjects would not have to jump from one "set" to the next for each problem. The order of cases within problems was randomized for each problem, with all subjects receiving the same order of cases. A consequence of these decisions regarding order of problem and case presentation is that practice effects render comparisons of performance by problem type meaningless. Such comparisons were judged to be of less interest

than the individual differences analyses of relations between verbal ability and task performance that were facilitated by a fixed order of presentation.

The major independent variable was presupposition type. The major dependent variable was deviation between predicted and actual case ratings.

Procedure

Subjects participated in small groups of up to six individuals. The theory formation task was presented first, followed by the real-world experience questions, and then by the verbal ability measure. Subjects completed the theory formation task at their own pace. There was a 20-minute time limit to complete the verbal ability test.

Results and Discussion

The results and discussion will be presented in two parts. Results presented in the first part concern the effects of manipulating presupposition on theory formation. Results presented in the second part concern relations between individual differences in verbal ability and theory formation.

Presupposition in Theory Formation

Were there effects of manipulating presupposition on performance on the theory formation task, and if so, did the manipulation facilitate the performance of the congruent

presupposition group and inhibit the performance of the incongruent presupposition group?

The results to be presented address, in turn, the magnitude, nature, and time course of the effects of manipulating presupposition on theory formation. The measure of task performance used for all analyses was the absolute value of the difference between predicted and actual rating values. It is important to keep in mind that with such a method of scoring, lower scores indicate higher levels of performance.

Magnitude of the effects of manipulating presupposition. Totaling the absolute value of differences between predicted and actual rating values across all nine problems yielded the following group means and standard deviations: congruent presupposition group 49.9 (9.3); neutral presupposition group 59.4 (9.3); incongruent presupposition group 99.9 (13.7). These means were reliably different, $F(2, 79) = 164.5$, $p < .001$, and in the expected order, with best performance (lowest scores) for the congruent presupposition group, poorest performance for the incongruent presupposition group, and the performance of the neutral presupposition group falling in between. The magnitude of these group differences is reflected in three observations: the performance of the congruent presupposition group was twice that of the incongruent presupposition group; significant group

differences were found for all nine problems; and the group means were in the expected order for eight of the nine problems.

Nature of the effects of manipulating presupposition. The neutral presupposition condition served as a baseline to determine whether (a) congruent presupposition facilitated theory formation, (b) incongruent presupposition inhibited theory formation, or (c) both were true. The results indicate that both were true. A priori contrasts indicated that the performance of the congruent presupposition group was reliably better than that of the neutral presupposition group, F (1, 53) = 14.34, $p < .001$, and that the performance of the incongruent presupposition group was reliably poorer than that of the neutral presupposition group, F (1, 52) = 161.5, $p < .001$.

Time course of the effect of manipulating presupposition. The time course of the presupposition manipulation was examined by totaling the absolute value of differences between predicted and actual rating values by trial position within problems, separately for each group. These results are plotted in Figure 1. A group by trial repeated measures analysis of variance with a polynomial

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Insert Figure 1 about here

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on the repeated measures factor of trial yielded (a) the expected effect of group identical to that reported above, F(2, 79) =

165.2, $p < .001$; (b) linear and quadratic effects of trial, $F(1, 79) = 124.5$, $p < .001$, and $F(1, 79) = 15.9$, $p < .001$, respectively; and (c) a group-by-linear trial interaction, $F(2, 79) = 51.3$, $p < .001$.

Consider the implications of these results for interpreting the data plotted in Figure 1. First, the overall differences among the three groups are reliable. Second, there is an overall trend of improved performance across trial position (the linear effect of trial), which represents learning, as well as a reliably greater amount of learning over earlier as opposed to later trials (the quadratic effect of trial). Finally, the rate of learning for the incongruent presupposition group appears to exceed that of the congruent and neutral presupposition groups (the effect of the group-by-trial interaction). The results plotted in Figure 1 also show that the effects of the presupposition manipulation did not wash out after the first trial or two, a finding supported by the observation that reliable group differences were found when only data from trials five through ten were analyzed, and in fact, the difference among groups in the final trial position was significant.

Theory Formation and Verbal Ability

With the practical sort of problems used in the present experiment, the theory formation task was conceptualized as a measure of practical, as opposed to academic, knowledge and

learning processes. Whereas it may be possible to use the theory formation task to investigate academic knowledge and learning processes by choosing problems from an academic domain, the present conceptualization of the task as a measure of practical knowledge and learning processes assumes that the theory formation task is not simply a proxy for an IQ test.

It was possible to evaluate this assumption by examining the correlation between task performance and performance on the verbal ability test subjects were given. This correlation was not reliably different from 0, $r(82) = -.10$, $p > .05$. This was also the case for the correlations calculated separately for the three groups. Thus, the theory formation task is not simply a proxy for an IQ test.

Summary

There were a number of important results. First, there were large effects of manipulating presupposition on theory formation. Second, by manipulating presupposition it was possible to both facilitate as well as inhibit performance on the theory formation task. Third, each group showed evidence of learning across trials within problems, with more learning for earlier as opposed to later trials, and more learning for the incongruent presupposition group compared to the other two groups. Fourth, the effect of manipulating presupposition did not wash out after a few trials, with reliable group differences occurring in data from second-half

trials. Fifth, the theory formation task is not just a proxy for an IQ test, based upon the absence of a reliable correlation between performance on the task and verbal ability.

Experiment 2

The first experiment concerned the role of presupposition--assumptions made before beginning a task--in everyday theorizing. The concern of Experiment 2 is with the role of supposition--assumptions made once a task has been started--in everyday theorizing.

The task used in this experiment was the same theory formation task that was used in Experiment 1, with an important exception. Midway through the trials of a given problem, the underlying theory was switched. As will be explained in more detail, it was possible to measure the effects of supposition by comparing the performance of two groups of individuals on identical cases, one group that presumably had acquired irrelevant supposition from having been given previous trials with a different underlying theory, the other group that had not.

Method

Subjects

The subjects were 64 undergraduates who received course credit for their participation, which took approximately 70 minutes.

Materials

The materials consisted of three theory formation problems, one each for the three tasks of purchasing a car, selecting an apartment, and choosing a roommate. Each of the problems was constructed by combining two problems from Experiment 1. Thus, each problem had 20 rather than 10 trials, and two underlying theories--one for trials 1 through 10, and a second for trials 11 through 20. In other respects, the materials were comparable to those of Experiment 1.

Two forms of the theory formation task--Form A and Form B--were constructed by counterbalancing order of underlying theory within problem. Consider the following example. A problem has the two underlying theories "I want a car that will meet the needs of my family" and "I want a car for investment purposes." The order of underlying theories for first- and second-trials would be "family car/investment purposes" for Form A, and "investment purposes/family car" for Form B. In other words, for Form A, the true rating for the first 10 trials would be based on the "family car" theory; the true rating for the second 10 trials would be based on the "investment purposes" theory. For Form B, the true rating for the first 10 trials would be based on the "investment purposes" theory; the true rating for the second 10 trials would be based on the "family car" theory.

The effects of supposition on the theory formation task could be examined in two comparisons. First, the performance on the "family car" trials could be examined across forms. There would be no previous trials to generate irrelevant suppositions on Form A because the "family car" trials came first. However, on Form B, the "family car" trials came second, so irrelevant supposition from the "investment purposes" is possible. Second, the performance on the "investment purposes" trials could be examined across forms. There would be no previous trials to generate irrelevant suppositions on Form B, whereas the "family car" trials would generate irrelevant suppositions on Form A.

Design

Subjects were randomly assigned to one of two groups. One group received Form A of the theory formation task, the other received Form B.

The major independent variable was order of underlying theory within problem trials, which corresponded to the presence or absence of irrelevant supposition. The major dependent variable was deviation between predicted and actual case ratings. The same verbal ability test used in Experiment 1 was given to subjects in this experiment.

Procedure

The procedure was identical with the procedure of Experiment 1, with the exception that the preliminary descriptions used to generate and manipulate presupposition in Experiment 1 were not presented in this experiment.

Results and Discussion

The results and discussion are presented in two parts. Results presented in the first part concern the effects of supposition in theory formation. Results presented in the second part concern relations between individual differences in verbal ability and theory formation.

Supposition in Theory Formation

The results to be presented here address, in turn, the magnitude and time course of the effects of manipulating supposition on theory formation.

Magnitude of effects of manipulating supposition. The absolute value of differences between predicted and actual rating values was totaled across the three problems separately for first-half and second-half trials. Recall that with this method of scoring, lower scores indicate higher levels of performance.

With the counterbalancing of underlying theories within problems, the effects of manipulating supposition were assessed by two comparisons. The first comparison was between the performance of Group 1 over first-half trials and the performance of Group 2

over second-half trials. Note that the stimulus items were identical for both groups for these trials. The only apparent difference was that Group 2 is assumed to have engaged in irrelevant supposition as a consequence of theorizing over trials 1 through 10. The means and standard deviations of interest here were 19.2 (5.2) for Group 1 performance over first-half trials, and 29.4 (6.1) for Group 2 performance over second-half trials. This group difference was reliable, $t(62) = 6.65$, $p < .001$, and in the expected direction. Thus, supposition as a consequence of prior theorizing inhibited the success of subsequent theorizing. The second comparison was the mirror image comparison between the performance of Group 1 over second-half trials and the performance of Group 2 over first-half trials. The means and standard deviations were 29.4 (5.7) for Group 1 over second-half trials, and 24.2 (4.0) for Groups 2 over first-half trials. Once again, this group difference was reliable, $t(62) = 4.23$, $p < .001$, and in the expected direction.

Time course of the effects of manipulating supposition. The time course of the effects of the supposition manipulation was examined by totaling the absolute value of differences between predicted and actual rating values by trial position within problems, separately for each group. These results are plotted in Figure 2. Note that performance is plotted for each group by

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Insert Figure 2 about here

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trial position. The advantage of this method of plotting performance is that it facilitates visual inspection of the effect of switching underlying theories at trial position 11. However, one should not attempt to compare performance of the two groups at any given trial position because the two groups were given different stimuli at each trial position. The way to interpret these results is to follow the change in performance for Group 1 when underlying theories were switched, and then, for replication, to follow the similar change in performance for Group 2.

A group by block order by trial repeated measures analysis of variance was carried out, with repeated measures on the block order and trial factors, and a polynomial contrast on the trial factor, yielding (a) an effect of block order, $F(1, 62) = 66.1$, $p < .001$; (b) linear, $F(1, 62) = 114.0$, $p < .001$, quadratic, $F(1, 62) = 13.9$, $p < .001$, and cubic, $F(1, 62) = 9.5$, $p < .01$ effects of trial; (c) a block order-by-linear interaction, $F(1, 62) = 5.7$, $p < .05$, and a block order-by-cubic interaction, $F(1, 62) = 36.1$, $p < .001$; and finally, and (d) effects of group, $F(1, 62) = 4.9$, $p < .05$, and of a group-by-block order interaction, $F(1, 62) = 5.5$, $p < .05$.

Consider the implications of these results for interpreting the data plotted in Figure 2. First, the obviously poorer performance for second-half as opposed to first-half trials is reliable. This result is evidence for inhibition due to irrelevant supposition from prior theorizing. Note that, in common with the durability of the effect of manipulating presupposition in Experiment 1, the effect of manipulating supposition was relatively long-lasting. It took five trials after the switch in underlying theories for performance to equal what it was at the very first trial position when subjects could do nothing but guess. The best performance after the switch in underlying theories never matched the best performance before the switch was made. The second implication is that with the exception of performance just after the switch in underlying theory, performance improves across trial positions (the linear effect of trial), thus documenting the expected effect of learning. Third, more learning occurred for earlier as opposed to later trials (the quadratic effect of trial). Fourth, the rate of learning was reliably greater after, as opposed to before, the underlying theories were switched (the block order-by-linear interaction). Fifth, for unexplainable reasons, performance after switching underlying theories had a cubic component. Finally, and uninterestingly, there were small but reliable group differences

in that Group 1 slightly outperformed Group 2 overall, and the effect of block order was slightly greater for Group 1.

Theory Formation and Verbal Ability

Recall that in Experiment 1, the correlation between verbal ability and performance on the theory formation task was not reliably different from 0. This result indicated that the theory formation task was not simply a proxy for an IQ test. In an attempted replication of this finding, the same verbal ability measure was given to subjects in the present experiment. Once again, the correlation between performance on the theory formation task and verbal ability was not reliably different from 0, $r(64) = -.13$, $p > .05$.

Summary

Irrelevant supposition as a consequence of prior theorizing inhibited the effectiveness of subsequent theorizing. This inhibition was persistent: The best performance after the switch in underlying theories did not match the best performance before the switch. Both groups showed evidence of learning, both before and after the switch in underlying theories. The rate of learning was greater for earlier as opposed to later trials, and after as opposed to before the switch in underlying theories. Finally, as was the case for Experiment 1, there was no reliable relation between verbal ability and performance on the theory formation task.

General Discussion

In this section I summarize the major results concerning supposition and presupposition in everyday theorizing. Next, I consider relations between the present results and other conceptions of intelligence and of expert learning and knowledge. Then, I point out several limitations of the present work, and I consider several issues for the future.

The results of Experiment 1 suggest that presupposition plays an important role in everyday theorizing. Considerable attention has been given to strategies for obtaining, evaluating, and combining information in learning and problem solving situations (see, e.g., Dansereau, Collins, McDonald, Holley, Garland, Diekhoff, & Evans, 1979; Newell & Simon, 1972; Polya, 1957; Rigney, 1980). An implication of the present results is that equally careful attention should be paid to assumptions that are generated before even entering the learning or problem solving situation.

Presupposition both facilitates and inhibits successful theorizing, depending upon the congruence of presupposition with a theory that accounts for the phenomenon to be explained. The magnitude of facilitation of successful theorizing is surprisingly large, based upon the result that performance on the theory formation task in the congruent presupposition condition was actually twice as accurate as performance in the incongruent

presupposition condition. What makes the magnitude especially surprising is that the presupposition manipulation involved changes in a single descriptive paragraph that was given at the beginning of the task. The duration of the effects of presupposition on theorizing is considerable, which suggests that presupposition involves more than an initial hunch or set of expectancies that are abandoned as soon as feedback is available.

The results of Experiment 2 provide empirical support for the notion that early experience shapes our interpretation of subsequent experience. Irrelevant supposition as a result of previous theorizing had detrimental consequences for subsequent theorizing. The effect of manipulating supposition was persistent: Group differences were found as a function of supposition even after considerable feedback had been given, and performance after the induction of irrelevant supposition never matched that before. Because of differences in the design and materials across the two experiments, it cannot be determined whether supposition facilitates as well as inhibits the success of subsequent theorizing, but it is likely that it does.

Finally, the results of both experiments suggest that everyday theorizing of the sort represented by the theory formation task depends upon abilities and processes other than those on which performance on traditional tests of verbal ability depend.

The kind of theorizing examined in the present study is the crux of intelligence in Wagner's (1986a) conceptualization, in which intelligence is conceptualized as the ability to create functional theories about oneself, others, and one's environment. This kind of theorizing also is related to a number of other recent conceptualizations of intelligence (Brown & Campione, 1986; Butterfield, 1986; Glaser, 1986; Snow, 1986; Schank, 1986; Sternberg, 1985). One aspect of Sternberg's (1985) triarchic theory of intelligence, which concerns three processes that are involved in profiting from experience, seems especially relevant to the present results.

Sternberg has proposed an experiential subtheory of intelligence that relates intelligence to learning and experience. Three processes are identified as being responsible, in part, for intelligence behavior in new situations. <u>Selective encoding</u> refers to sifting out relevant information from irrelevant. <u>Selective combination</u> refers to combining isolated pieces of information into a meaningful whole. <u>Selective comparison</u> refers to relating new information to old.

It is intriguing and more than mildly suggestive that the three processes proposed by Sternberg represent three of the major functions of a theory, namely, (a) to prevent the observer from being overwhelmed by the full-blown complexity of any phenomenon (i.e., selective encoding), (b) to serve as a framework for

organizing what may on the surface appear to be unrelated observations (i.e., selective combination), and (c) to incorporate present results with previous findings (i.e., selective comparison).

There are at least two interpretations one might offer for the correspondence between theorizing and the processes of selective encoding, combination, and comparison. The first interpretation is that selective encoding, combination, and comparison are processes that underlie theorizing. On this view, a better understanding of individuals' everyday theorizing might be gained by further study of the operation of these three processes. The second interpretation is that selective encoding, combination, and comparison represent by-products of theorizing. On this view, a better understanding of how individuals selectively encode, combine, and compare information might be gained by further study of the phenomenon of theorizing. Whether these views can be differentiated empirically, or whether which view one chooses depends on one's purpose remains to be determined.

The present results would appear to have relevance for the study of expert-novice differences in knowledge and its acquisition. Expert-novice differences in performance--in both academic (Chi, Feltovich, & Glaser, 1981; Larkin, 1981; Larkin, Mcdermott, Simon & Simon, 1980) and practical domains (Chiesi,

Spilich, & Voss, 1979; Wagner, 1986b; Wagner & Sternberg, 1985, 1986)--derive more from differences in knowledge and how it is structured, than from differences in underlying cognitive abilities. What is less clear is how experts acquire and make use of their knowledge.

An implication of the present results is that a viable approach to further study of how experts acquire and make use of their knowledge is through study of the processes and products of their theorizing. An example of one such approach is provided for purposes of illustration. The approach involves comparing the performance of experts and novices on a theory formation task made up of problems from the domain of expertise. Of special interest would be examining the pattern of expert-novice differences across trial position. Because presupposition takes place, by definition, before the first trial, the effects of presupposition should be apparent from the first trial position. The effects of supposition, which, in the present context, refers to hunches based upon initial feedback, should be apparent beginning at the second trial position and lasting for perhaps several trial positions. The effects of response to feedback should be apparent in the slopes of performance plotted across trial position, in that these slopes reflect improvement in performance across the trial positions.

Consider three possible patterns that suggest different loci of expert-novice differences. First, consider the possibility that expert-novice differences are confined largely to differences in presupposition. This possibility is consistent with the observation that at a hallmark of expertise is the ability to perceive large, meaningful patterns of information rapidly (Glaser, 1986). In this case, one would expect differences between experts and novices at the first trial position (reflecting differences in presupposition), with comparable slopes across remaining trial positions (reflecting comparable supposition and response to feedback). Second, consider the possibility that expert-novice differences are confined largely to supposition. In other words, experts are better at generating good hunches from initial experience. In this case, one would expect (a) equivalent performance at the first trial position (reflecting comparable presupposition), (b) differences in slope across the next few trial positions (reflecting differences in supposition), and (c) comparable slopes thereafter (reflecting comparable response to feedback). Third, consider the possibility that expert-novice differences are confined largely to response to feedback. In other words, experts are better able to profit from their experience. In this case, one would expect comparable performance at the first trial position (reflecting comparable presupposition), with different slopes across the remaining trial

positions (reflecting differences in response to feedback and comparable supposition). In all probability, some combination of these possible outcomes would likely hold.[3]

There are several caveats to keep in mind concerning the results of the present experiments. One is that the results would seem to apply to some kinds of learning situations but not others. The theory formation task was a fairly difficult one in that there were a large number of possible theories that might underlie each problem, and the feedback subjects received did not immediately eliminate all but the correct one. Simpler, less difficult tasks might yield very different results. For example, consider a highly simplified concept identification task for which the concept is the color red, and the only feature that varies is color, red or blue. Presupposition is of little use here, because feedback from the first trial alone would enable correct identification of the concept. This example is admittedly extreme, and it is likely that everyday learning and problem solving situations are more similar to the problems of the type used in the theory formation task than to such a simplified concept identification task. However, it is probable that even realistic learning and problem solving situations differ in the relative usefulness and importance to successful performance of proficient presupposition and supposition on the one hand, and proficient seeking out and responding to feedback, on the other.

A second caveat is that it was assumed rather than demonstrated that what were intended as manipulations of presupposition and supposition, were in fact, manipulations of presupposition and supposition as opposed to something else. This is a problem for all experimental work, but one that is important to deal with here because it is difficult to determine the the appropriate manipulation checks for presupposition and supposition. Also, the results themselves are to some degree expected rather than counterintuitive. There are ample demonstrations of various kinds of expectancy effects in perception and learning. The value of the present results is in providing an empirical demonstration of such effects in a complex, realistic learning situation, and in incorporating these effects into a larger theory of intelligence (Wagner, 1986a).

There are at least several approaches to dealing with the issue of whether it is presupposition that matters as opposed to more global expectancy effects. One approach is to devise a training program that is based as much as possible on presupposition. An example might be training a strategy for identifying one's presuppositions and then challenging them by, say, assuming just the opposite. The effects of such training would be compared to the effects of training programs based upon other plausible explanations of the findings. A related approach involves the use of experts and novices in a given domain. This

approach would involve indentifying the presuppositions made by experts. It should not be difficult to get experts to provide at least some of their presuppositions, even if they cannot readily explain or justify them. Then, one could examine the amount of improvement, if any, that results by giving the expert's presuppositions to novices.

In addition to efforts to train theorizing, there are a number of unresolved issues for the future. First, how, does presupposition differ from set effects in problem solving or any other kind of expectancy? Second, what are the relations between the theories that are the product of everyday theorizing and other kinds of knowledge representations including schemas (Bartlett, 1932) and rules (Siegler, 1981)? Third, what are the characteristics associated with successful theorizing? For example, a characteristic that might be associated with successful theorizing is a preference for simple, but testable theories, over more complicated, but less testable ones. A second example might be a tendency not to give up on a theory in the face of initially disconfirming evidence.

A popular slogan in a cigarette commercial a number of years ago was "It's what's up front that counts." If applied to everyday theorizing, this slogan no doubt overstates the importance of supposition and presupposition to successful theorizing. Successful theorizing depends upon factors other than

supposition and presupposition, including inclination and ability to seek out, evaluate, and implement feedback. The point of the present results is that "what's up front counts too."

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Footnotes

[1]There is considerable variation in usage for the word theory. Some prefer to reserve the label theory for formal theories such as the frequency theory of pitch perception. For others, a theory is simply a framework--tentative or well-established--for explaining some phenomenon. The present usage is closer to the latter than the former. An acceptable definition for present purposes is a set of assumptions or conventions related to one another and to a set of empirical definitions (Hall & Lindzey, 1970).

[2]That functional theorizing has implications for learning as well as intelligence is suggested by the fact that the theory formation task is in many respects similar to the concept formation tasks used in learning research.

[3]A potential problem for this approach is the possible nonindependence of presupposition, supposition, and responding to feedback. For example, it may be the case that one's presuppositions must be of a certain level of accuracy before meaningful response to feedback is possible.

Table 1

Theories, Constructs, and Examples of Concrete Descriptions used in Experiment 1.

Theory	Construct	Descriptions
Automobile Purchase Problems		
1. I want a car that meets	Functional	4-door sedan
the needs of my family.	Safety	air bags
2. I want a car that will	Cheap to purchase	low-priced
provide basic transportation.	Cheap to maintain	low insurance rates
3. I want a car for	Appreciation	excellent resale value
investment purposes.	Durability	low freq. of repairs
Apartment Selection Problems		
4. I want an apartment that	Companionship	friends rent there
meets my social needs.	Entertainment	frequent parties

Table 1 (Cont.)

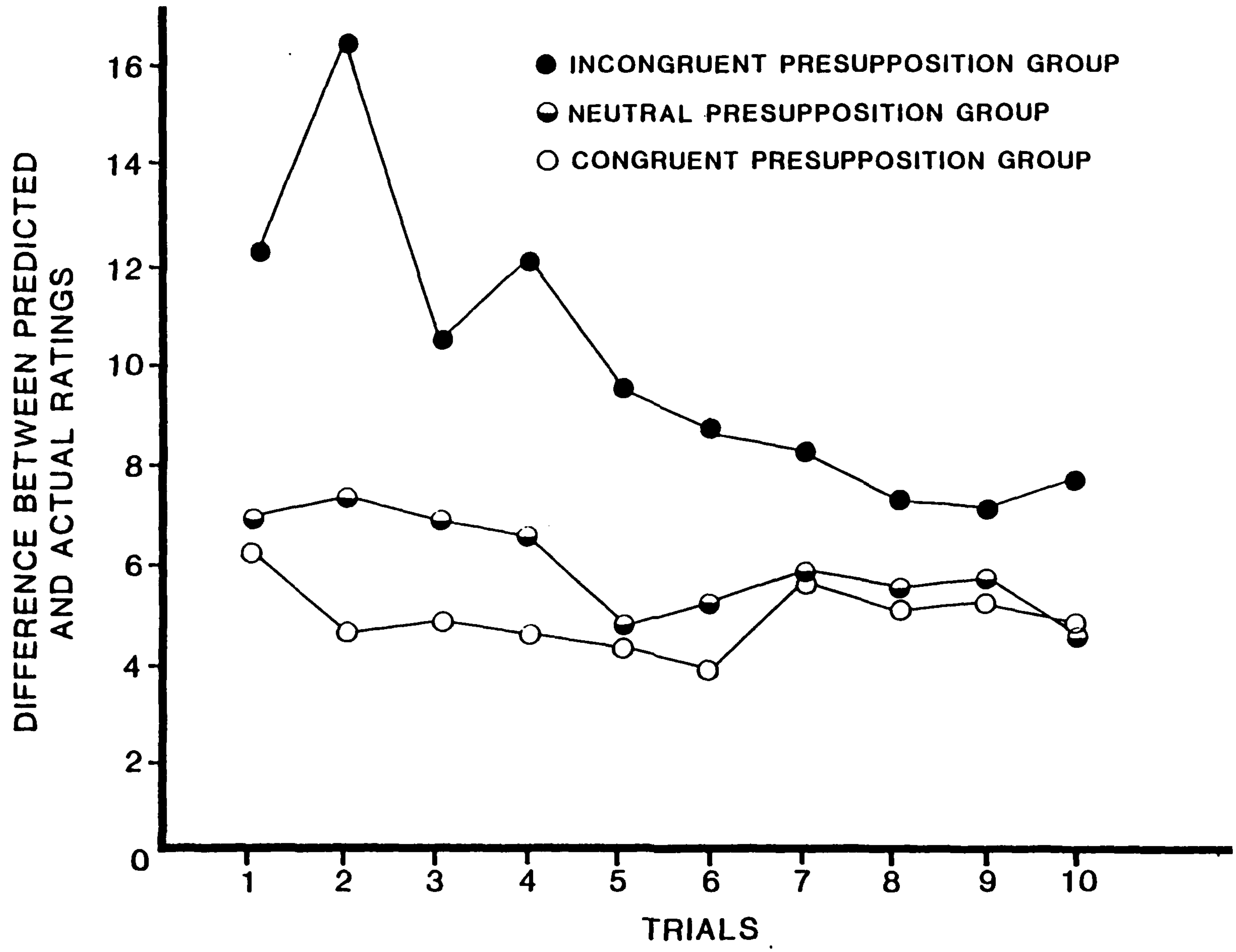
Theory	Construct	Descriptions
5. I want an apartment that provides basic housing.	Inexpensive to rent	small security deposit
	Inexpensive to maintain	well-insulated
6. I want an apartment that is prestigious in every way.	Amenities	doorman
	Desirable location	influential tenants
<u>Roommate Selection Problems</u>		
7. I want a roommate whom I will be compatible with.	Similar habits	gets up at same time I do
	Similar interests	same taste in music
8. I want a roommate who will be helpful.	Solvent	employed
	Dependable	insists on signing lease
9. I want a roommate who will be fun to live with.	Companionship	a good friend
	Enrichment	will teach me to play guitar

Table 2

Sample Case Description From a Car Purchase Problem

This used car seats 6 comfortably. It has few options and is priced well below average for a car of this size. It is equipped with a standard transmission. There is adequate luggage space, and the fuel tank is located near the rear axle to avoid rupture. The car has 50,000 miles on the odometer. Insurance rates are low for this model. Labor charges for repair work also are low.

Fiyure 1. Mean differences plotted by trial position between predicted and actual ratinys totaled across problems: Experiment 1.



INCONGRUENT PRESUPPOSITION GROUP
NEUTRAL PRESUPPOSITION GROUP
CONGRUENT PRESUPPOSITION GROUP
DIFFERENCE BETWEEN PREDICTED AND ACTUAL RATINGS
0
2
4
6
8
10
12
14
16
1
2
3
4
5
6
7
8
9
10
TRIALS

Figure 2. Mean differences plotted by trial position between predicted and actual ratings totaled across problems: Experiment 2.

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Footnotes

[1]There is considerable variation in usage for the word theory. Some prefer to reserve the label theory for formal theories such as the frequency theory of pitch perception. For others, a theory is simply a framework--tentative or well-established--for explaining some phenomenon. The present usage is closer to the latter than the former. An acceptable definition for present purposes is a set of assumptions or conventions related to one another and to a set of empirical definitions (Hall & Lindzey, 1970).

[2]That functional theorizing has implications for learning as well as intelligence is suggested by the fact that the theory formation task is in many respects similar to the concept formation tasks used in learning research.

[3]A potential problem for this approach is the possible nonindependence of presupposition, supposition, and responding to feedback. For example, it may be the case that one's presuppositions must be of a certain level of accuracy before meaningful response to feedback is possible.

Table 1

Theories, Constructs, and Examples of Concrete Descriptions used in Experiment 1.

Theory	Construct	Descriptions
Automobile Purchase Problems		
1. I want a car that meets the needs of my family.	Functional	4-door sedan
	Safety	air bags
2. I want a car that will provide basic transportation.	Cheap to purchase	low-priced
	Cheap to maintain	low insurance rates
3. I want a car for investment purposes.	Appreciation	excellent resale value
	Durability	low freq. of repairs
Apartment Selection Problems		
4. I want an apartment that meets my social needs.	Companionship	friends rent there
	Entertainment	frequent parties

Table 1 (Cont.)

Theory	Construct	Descriptions
5. I want an apartment that provides basic housing.	Inexpensive to rent	small security deposit
	Inexpensive to maintain	well-insulated
6. I want an apartment that is prestigious in every way.	Amenities	doorman
	Desirable location	influential tenants
Roommate Selection Problems		
7. I want a roommate whom I will be compatible with.	Similar habits	gets up at same time I do
	Similar interests	same taste in music
8. I want a roommate who will be helpful.	Solvent	employed
	Dependable	insists on signing lease
9. I want a roommate who will be fun to live with.	Companionship	a good friend
	Enrichment	will teach me to play guitar

Table 2

Sample Case Description From a Car Purchase Problem

This used car seats 6 comfortably. It has few options and is priced well below average for a car of this size. It is equipped with a standard transmission. There is adequate luggage space, and the fuel tank is located near the rear axle to avoid rupture. The car has 50,000 miles on the odometer. Insurance rates are low for this model. Labor charges for repair work also are low.

Figure 1. Mean differences plotted by trial position between predicted and actual ratings totaled across problems: Experiment 1.

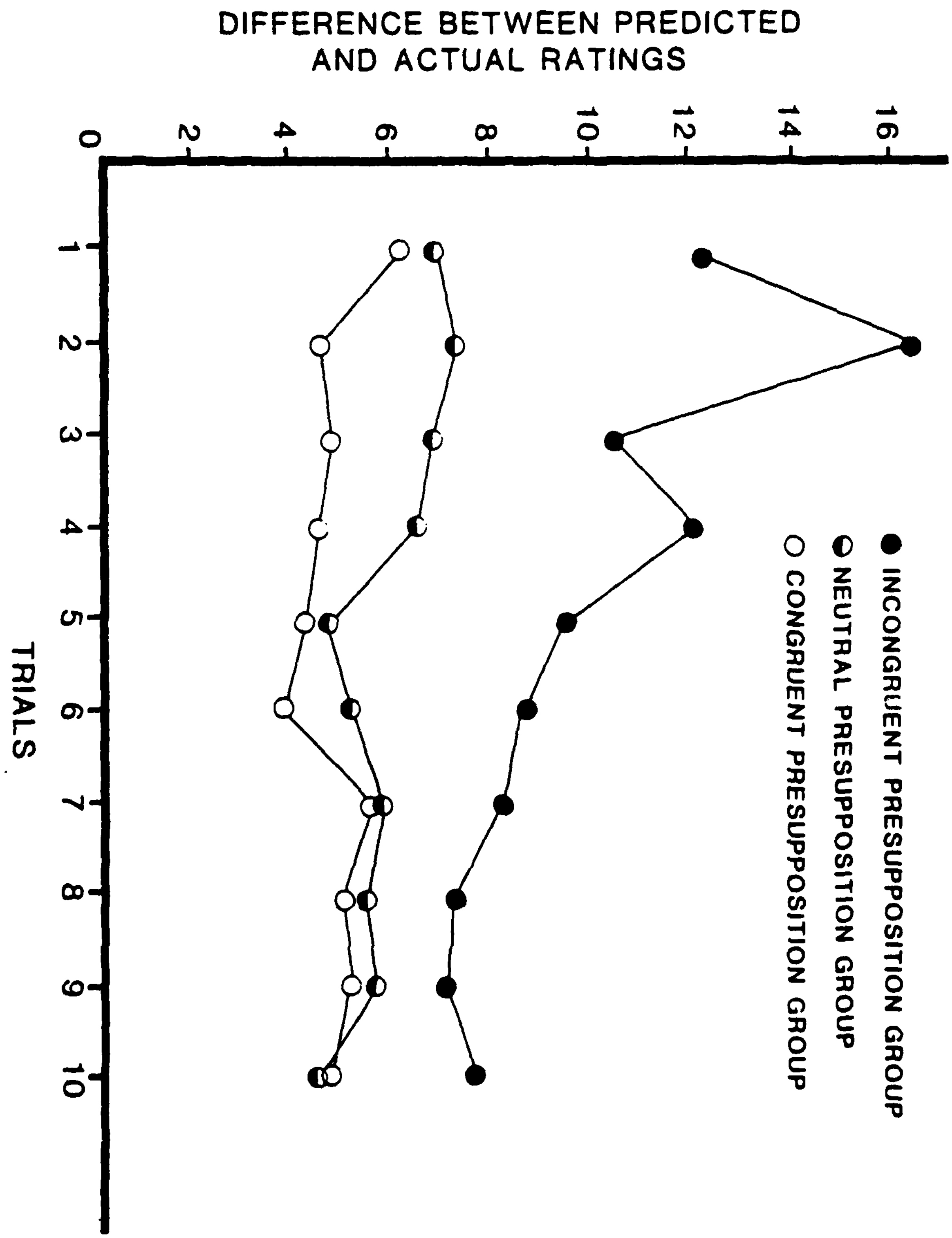
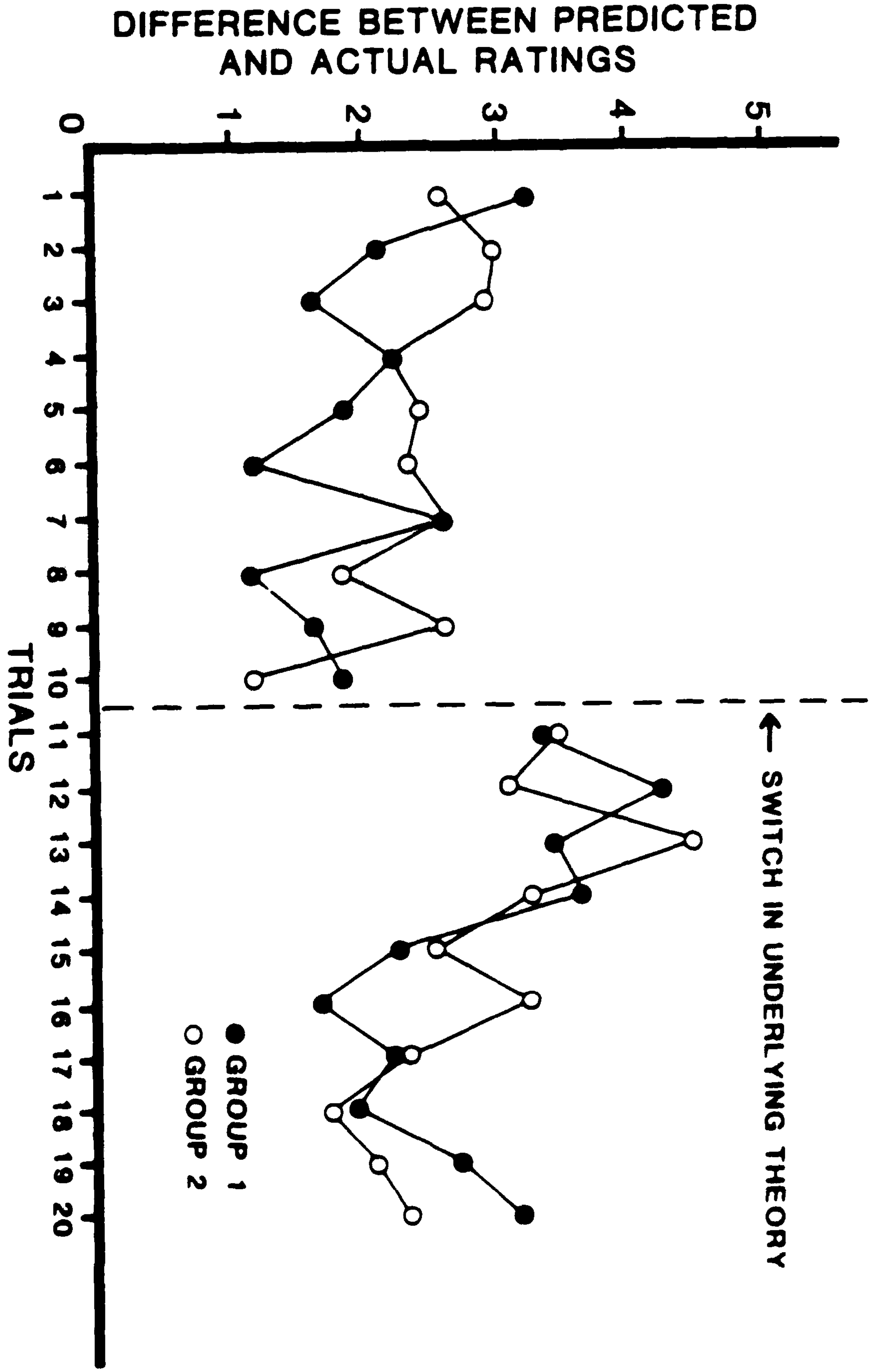

DIFFERENCE BETWEEN PREDICTED AND ACTUAL RATINGS
0
2
4
6
8
10
12
14
16
1
2
3
4
5
6
7
8
9
10
TRIALS
INCONGRUENT PRESUPPOSITION GROUP
NEUTRAL PRESUPPOSITION GROUP
CONGRUENT PRESUPPOSITION GROUP

Figure 2. Mean differences plotted by trial position between predicted and actual ratings totaled across problems: Experiment 2.


DIFFERENCE BETWEEN PREDICTED AND ACTUAL RATINGS
0
1
2
3
4
5
TRIALS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
← SWITCH IN UNDERLYING THEORY
● GROUP 1
○ GROUP 2